CLAIMS

WE CLAIM:

1. A isolated single mutant RecA protein comprising a deletion of at least 13 –20 amino acids residues from the carboxyl terminus.

2. The protein of Claim 1 wherein 17 amino acid residues are deleted from the carboxyl terminus, as set forth in SEQ ID NO. 1.

3. A polynucleotide sequence, as set forth in SEQ ID NO. 2, encoding the protein of claim 2.

4. The protein of Claim 1 comprising an enhanced capacity to displace a DNA binding protein as compared to wild-type RecA.

5. The protein of Claim 1 wherein the DNA binding protein is SSB.

6. The protein of Claim 1 comprising enhanced binding to DNA during a DNA strand exchange reaction as compared to wild-type RecA.

7. The protein of Claim 6 wherein the DNA is single-stranded.

8. The protein of Claim 6 wherein the DNA contains secondary structure.

9. A isolated double protein RecA protein comprising a deletion of at least 13 - 25 amino acids residues from the carboxyl terminus and the amino acid change from a glutamate to a basic amino acid at position 38.

10. The protein of Claim 9 wherein 17 amino acids residues are deleted from the carboxyl terminus.

11. The protein of Claim 9 wherein the basic amino acid is to lysine.

12. The protein of Claim 9 wherein the basic amino acid is to arginine.

13. The protein of Claim 9 wherein 17 amino acids residues are deleted from the carboxyl terminus and the glutamate is changed to lysine, as set forth in SEQ ID NO. 3.

14. A polynucleotide sequence, as set forth in SEQ ID NO. 4, encoding the protein of Claim 13.

15. The protein of Claim 13 comprising an enhanced capacity to displace a DNA binding protein as compared to wild-type RecA.

16. The protein of Claim 15 wherein the DNA binding protein is SSB.

17. The protein of Claim 13 comprising an increased steady-state DNA binding capacity during a DNA strand exchange reaction as compared to wild-type RecA.

18. The protein of Claim 17 wherein the DNA is single-stranded.

19. The protein of Claim 17 wherein the DNA is double-stranded.

20. The protein of Claim 19 wherein the double-stranded DNA is linear or circular.

21. The protein of Claim 17 wherein the DNA strand exchange reaction is pH dependent.

22. The protein of Claim 21 wherein the DNA strand exchange reaction induces complete product formation at a pH between 7.5 - 9.5.

23. The protein of Claim 21 wherein the DNA strand exchange reaction induces complete product formation at a pH of 8.5 ($\pm$ 1.0).

24. The protein of Claim 17 wherein the DNA strand exchange reaction is Mg2+ concentration dependent.

25. The protein of Claim 24 wherein the Mg2+ concentration is between 4mM – 8mM.

26. The protein of Claim 24 wherein the Mg2+ concentration is 5mM.

27. The protein of Claim 13 wherein the protein promotes an extended reaction.

28. The protein of Claim 27 wherein the extended reaction is at least a three-strand exchange reaction.

29. A method of catalyzing in vitro homologous DNA pairing and DNA strand exchange reactions comprising providing a sufficient amount of the protein of Claim 1.

30. A method of catalyzing in vitro homologous DNA pairing and DNA strand exchange reactions comprising providing a sufficient amount of the protein of Claim 9.

31. A method of increasing recombination efficiency of homologous DNA pairing and DNA strand exchange reactions in a cell comprising supplying to the cell a sufficient amount of the protein of Claim 1.

32. A method of increasing recombination efficiency of homologous DNA pairing and DNA strand exchange reactions in a cell comprising supplying to the cell a sufficient amount of the protein of Claim 9.

33. A kit comprising the protein of Claim 1.

34. A kit comprising the protein of Claim 2.

35. A kit comprising the protein of Claim 9.

36. A kit comprising the protein of Claim 13.